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A Revision of the North American Species of Scleropodium

By A. J. Grout

SCLEROPODIUM Br. & Sch. Bry. Eur. 1853

Closely allied to *Brachythecium* and included in it by some authors ; differing slightly in the general habit and in the julaceous branches with concave, often obtuse leaves ; leaf cells very long and narrow, 10–20 : 1. Stem leaves abruptly and slenderly acuminate in most species. Seta rough ; capsule as in *Brachythecium*. All of our species are western. *S. illecebrum* and *S. caespitosum* are also European.

1. Leaves broadly ovate to suborbicular, without pointed apex or at most short-cuspidate ; auricles distinct, consisting of plainly dilated cells ; aquatic. *S. obtusifolium.*
Leaves ovate to lanceolate ; stem leaves slenderly acuminate, without distinct auricles ; terrestrial. 2.
2. Leaf cells 14–18 : 1, differentiated basal and alar cells few. 3.
Leaf cells 7–12 : 1, differentiated basal and alar cells in several rows. 4.
3. Branch leaves ovate-lanceolate to lanceolate, acute to acuminate ; capsules suberect and nearly symmetric. *S. colpophyllum.*
Branch leaves ovate to oblong-ovate, obtuse to abruptly short-acuminate ; capsules horizontal and unsymmetric. *S. illecebrum.*
4. Branches slightly julaceous ; capsules suberect and nearly symmetric. *S. caespitosum.*
Branches strongly julaceous ; capsules more arcuate and unsymmetric. *S. apocladum.*

This genus is perhaps too near *Brachythecium* and one species referred to it by most authors (*S. Californicum*) is most certainly a *Brachythecium*. The relationship with *Eurhynchium* is much more distant and Sullivant's reference of *S. colpophyllum* to that species is hard to understand when one has a large series of plants for comparison. The relationship between *S. colpophyllum* and *S. caespitosum* is so close that about half the specimens of the former in American herbaria have been referred to the latter.

I am greatly indebted to the United States National Museum, Harvard University, The University of Wisconsin, and Mr. J. M. Holzinger for the loan of specimens. The work has been largely done at the Herbarium of Columbia University and was made possible by the kindness of Prof. Underwood and Mrs. Britton.

SCLEROPODIUM ILLECEBRUM (L. *p.p.*) Br. Sch. Bry. Eur. *pl.* *557.* 1853

Muscus terrestris surculis kali geniculati aut illecebrae, aemulis etc. Vail. Botan. Paris 137, *pl. 25. f. 7.* 1727.

Hypnum illecebrum L. *p.p.* Sp. Pl. 1129. 1753.

Hypnum Touretii Brid. Sp. Musc. **2**: 185. 1812.

Hypnum illecebrum Schwaegr. Suppl. **1**, part 2: 225. 1816.

Hypnum blandum Lyell in Hook. & Tayl. Musc. Brit., Ed. 2: 176. 1827. Suppl. *pl. 5.* 1827.

Gametophyte in wide spreading mats, varying from dirty green to bright glossy green: stems 3–10 cm. long, creeping, irregularly divided, irregularly or often subpinnately branching, partially denuded of leaves in the older portions, sparingly radiculose, younger portions ascending and much like the branches: branches short, rarely reaching 1 cm. in length, julaceous, turgid, ascending to erect, more or less arcuate, usually obtuse: branch-leaves appressed imbricate when dry, erect open when moist, varying greatly in shape; those from the middle of the larger branches broadly ovate to oblong-ovate, 1.2 × 0.6 mm., abruptly narrowed to a short point, finely and sharply serrate above, sometimes nearly entire, very concave, slightly sulcate when dry, smooth when moist, not decurrent but half clasping, acumination of leaves often squarrose-spreading when dry; costa extending ¾ the length of the leaf, sometimes ending in a dorsal spine; median cells linear-vermicular, 0.005 mm. wide and 12–18 : 1, apical much shorter; basal subquadrate, colored and thicker walled; alar somewhat larger and less deeply colored; leaves of the shorter branches and upper and lower leaves of the longer branches often lack the acumination and are obtuse or obtusely acute: stem leaves averaging larger, in robust plants reaching 2.3 × 1 mm., gradually tapering to a longer acumination, nearly or quite entire, those of the younger stems scarcely to be distinguished from the branch leaves. Dioicous: perichaetial leaves oblong-lanceolate, gradually narrowed above to a slender entire or subdenticulate acumination, faintly costate, acumination less slender than in *S. caespitosum.*

Sporophyte 1–2 cm. high: seta greenish brown, becoming red brown with age, twisted to the right, very rough with large papillae: capsule a little lighter colored than the seta, horizontal, unsymmetric or arcuate, with operculum 2.5 mm. long, 2.5–3 : 1; operculum long-conic, acute; annulus of two rows of cells, easily deciduous ; teeth united at base, nearly colorless and papillose above ; segments nearly as long as the teeth, finely papillose, from basal membrane equaling two fifths the length of the teeth ; cilia 2, well developed, appendiculate ; spores nearly smooth, maturing in winter.

Forma *pinnatifidum* from California in the Gray Herbarium at Harvard is more slender and nearly regularly pinnate.

Type locality, France near Paris. Type at Paris.

On shady grassy soil and on shaded rocks.

California, Idaho, Washington, British Columbia, Vancouver.

EXSICCATI : Sulliv. & Lesq. Musc. Bor.-Am., Ed. 2, 508.

ILLUSTRATIONS : Bry. Eur. *pl. 557 ;* Husnot, Musc. Gall. *pl. 95;* Dixon & Jam. Handb. Brit. Mosses, *pl. 53, G ;* Limpricht, Rab. Krypt. Fl. **4** : *f. 378.*

The robust habit, julaceous turgid branches, and thick unsymmetric horizontal capsules make this species easy to recognize when typical. It grades insensibly into *S. obtusifolium* and it is often very hard to say to which species certain forms should be referred.

SCLEROPODIUM OBTUSIFOLIUM (Hook.) Kindb. Cat. Can. Pl. **6** : 202. 1892

Hypnum obtusifolium Hook. Drumm. Musc. Am. no. 193.

Hypnum arcticum var. Muell. Syn. **2** : 432. 1851.

Stereodon obtusifolius Mitt. Journ. Linn. Soc. **8** : 42. 1865.

Gametophyte submerged or nearly so, attached to stones in brooks, light green above, brown below : stems irregularly branching, naked below and roughened by the leaf bases of the fallen leaves ; young stems and branches julaceous ; branches 5–20 mm. long : leaves close imbricate and appressed when dry, more open when moist, broadly ovate to suborbicular, very concave, spoon shaped, round-obtuse, without acumination or very shortly cuspidate, 1.2 × 1 mm., not plicate or sulcate except under pressure, entire or faintly denticulate near apex ; costa stout, extending five sixths the length of the leaf ; median leaf cells linear vermicular, 0.05–0.065 mm. long, 8–10 : 1 ; apical cells broader and shorter, 2–3 : 1 ; alar cells rather abruptly enlarged to form distinct auricles, 0.013 mm. long, 3 : 1.

Type from rivulets in the Rocky Mts., Drummond. Type not seen, probably at Kew.

Described from Drummond's Musc. Am. 193, which is sterile.

California, Nevada, Idaho, Montana, Washington, Oregon, British Columbia.

EXSICCATI: Macoun's Canadian Musci 359 is very much larger and in every way more robust than the type, but has all of the distinctive microscopic characters. The same is true of Renauld and Cardot's Musc. Sept. Exs. 111. Sullivant and Lesquereux, Musc. Bor.-Am., edition 2, no. 509 (*Hypnum illecebrum* var.), is fairly representative of the species and bears the mature sporophyte, which differs little from that of *S. illecebrum.* The capsule is a little shorter and there are sometimes as many as four strongly nodose cilia in the endostome: the seta is exceedingly rough with very high papillae: operculum short rostrate when dry.

There can be no doubt that this should be regarded as a subspecies of *S. illecebrum.* The plants nearest the type are always submerged and nearly always sterile. A complete series can be traced from the typical form described above to typical *S. illecebrum.* M. Cardot in Hedwigia **32**: 345. 1893, states that he has come to the conclusion that *S. obtusifolium* is a water form of *S. illecebrum* and states that the latter varies greatly in the characters which separate the two species. He also states that he has found these variations in the same tuft. It seems probable, however, from what he says that he had at hand specimens of the more common form of *S. obtusifolium*, which is more robust than the type or than *S. illecebrum* itself. Drummond's 193 is less robust than *S. illecebrum.*

M. Cardot also informs me that he and M. Renauld first suggested to Prof. Kindberg that *Hypnum obtusifolium* is a *Scleropodium.* This fact Prof. Kindberg failed to acknowledge in his publications.

Dr. M. A. Howe has collected specimens on moist, shady banks at Berkeley, California, June 28, 1894, that have the leaf characters of the typical form, except that the leaves are longer in proportion to their width. This goes to show that the submerged growth is not the cause of the inflated alar cells, shorter leaf cells and more concave leaves.

In some cases the plants are flaccid with more distant, less closely appressed leaves constituting forma *laxum.*

A form from Goldstream, Vancouver Island, Macoun, May 18, 1887, has erect branches 3–4 cm. long, strongly curved at the ends, bearing suborbicular, strongly secund leaves 2 mm. in length. For this I suggest the name var. *homomallum*. This variety is the extreme development of the robust form while the typical form is at the other extreme.

Scleropodium apocladum (Mitt.)

Hypnum apocladum Mitt. Journ. Linn. Soc. **8**: 35. 1865.

Gametophyte in wide interwoven mats of medium thickness, light green above, dirty green below the surface, somewhat resembling *Eurhynchium strigosum praecox* in appearance: stems creeping, 1–4 cm. long, irregularly branching: branches often fascicled, simple or sparingly divided, 3–8 mm. in length, julaceous, attenuate: branch leaves appressed-imbricate when dry, those on the branches below the surface of the mat erect spreading, ovate, acute to short-acuminate, scarcely decurrent, slightly serrulate at apex, otherwise nearly entire in the type, other specimens finely serrulate nearly to the base, somewhat concave, not plicate or sulcate; costa extending at least four fifths the length of the leaf, stout; median cells linear-oblong, 7–9 : 1; quadrate basal and alar cells very numerous; apical cells broader and shorter; the leaves near the apex of the branches narrower and more longly acuminate: leaves of creeping stems variable in shape, semiorbicular and abruptly short-acuminate to ovate and longer acuminate. Perichaetium 4.5 mm. long, the inner leaves long lanceolate, long and slenderly acuminate, slightly serrulate, some faintly costate (Mitten says "nerved to above middle"). Sporophyte about 12 mm. high: seta red-brown, in the type plainly papillose with low distant papillae, in other specimens strongly roughened: capsule red-brown, about 2 mm. long, 3–4 : 1; "suberect, oval cylindrical," in other specimens inclined to horizontal, unsymmetric; operculum conic-apiculate; annulus of two rows of cells; segments nearly as long as the teeth, split between the articulations; cilia two, strongly appendiculate; spores smooth, 0.013 mm.

A fragment of Mitten's type from "The Northwest Coast, Douglas" has been accessible, and a specimen from the United States National Museum collected at Pasadena, California, by Dr. Palmer, and determined as *S. caespitosum* has been carefully compared with this fragment. The two agree in all essential particulars. The leaves of Dr. Palmer's specimen are more acuminate and more serrulate, the seta is rougher and the capsule more unsymmetric and inclined, but these differences are no greater than frequently occur in individuals of the same species. The seta in the type is much rougher than the original description would lead one to expect.

The leaf cells are much shorter than in most species of the genus, but in all other particulars it seems closely related to the other species.

Type in Mitten Herbarium.

SCLEROPODIUM CAESPITOSUM (Wils.) Br. & Sch. Bry. Eur. *pl. 556.* 1853

Hypnum caespitosum Wils. English Bot. Suppl. *pl. 2878.* 1849. Also Bry. Brit. 344. *pl. 55.* 1851.

Hypnum caespitans C. Muell. Syn. **2**: 354. 1851.

Eurhynchium colpophyllum flagelliforme Barnes, Bot. Gaz. **16**: 207. 1891.

Gametophyte in rather thin loosely interwoven mats, light or dirty green: stems creeping, 5–10 cm. long, irregularly divided and branching; branches usually longer and more slender than in *S. illecebrum*, tapering, sometimes julaceous, but less frequently so than in *S. illecebrum*: branch leaves, from the middle of the branches 0.9–1 × 0.3–0.4 mm., ovate to oblong-lanceolate, usually tapering and acute at apex but sometimes nearly as obtuse as in *S. illecebrum*, appressed and imbricate to erect-open when dry, concave, scarcely plicate when moist, not decurrent, finely serrate at apex; median cells narrowly linear-vermicular, 8–12 : 1; quadrate basal cells in several rows, alar little differentiated from the other basal cells; apical cells broader and shorter; costa stout, frequently forked, extending three fourths the length of the leaf, often ending in a spine at the back of the leaf; stem leaves ovate to ovate-lanceolate, slenderly acuminate, with a larger number of short basal and alar cells, alar cells somewhat enlarged at the decurrent angles. Dioicous; inner perichaetial leaves loosely sheathing at base, gradually narrowed to a long subfiliform and suberect acumen, distantly and slightly denticulate above or sometimes entire, faintly costate.

Sporophyte 10–15 mm. high: seta red-brown, twisted to the right, very rough: capsule light brownish-green, oblong cylindric, suberect, slightly unsymmetric, with operculum 2–2.5 mm. long, about 2.5 : 1; operculum conic-apiculate to conic-rostellate, often appearing short rostrate when dry; annulus of two rows of cells, deciduous; teeth of peristome slender, subhyaline and slightly papillose at apex; segments nearly as long as the teeth, yellowish, more strongly papillose, from a wide basal membrane and widely open between the articulations; cilia two, very strongly nodose; spores rough, about .016 mm., maturing in winter.

Type locality, Langford, near Warrenton, England.

Growing on stumps and old logs, roots of trees and rocks. California, Washington, Oregon, Vancouver Island, Lake Athabasca (Macoun), Alaska (Kellogg).

ILLUSTRATIONS: See above; also Dixon and Jameson, *pl. 153, B;* Husnot, Musc. Gall. *pl. 115.*

EXSICCATI: As *Hypnum caespitosum;* Sull. & Lesq. Musc. Bor.-Am. 510; Macoun, Can. Musc. 290 (In part only. See under *S. colpophyllum.*)

Sterile and robust *S. caespitosum* is hard to distinguish from *S. illecebrum.* In general it is more slender, less frequently julaceous with closely imbricated leaves, with tapering branches and narrower more gradually tapering leaves having their median lea cells longer and rather narrower and the differentiated basal cells more numerous. It also comes very close to slender forms of *S. colpophyllum.*

Sullivant and Lesquereux's exsiccati (*l. c.*) do not agree very closely with Wilson's Musc. Brit. 349, or with the plate in the Bryologia Europaea. The stem leaves are too abruptly acuminate with too short an acumen. This is a variation in the direction of *S. obtusifolium,* but as these characters are variable according to Wilson's own description, these specimens should probably be referred to a form of *S. caespitosum.* Dr. M. A. Howe has collected a moss on "Redwood stumps, Mill Valley, Marin Co., California, January 16, 1892," that agrees very closely with Wilson's exsiccati so that there can be no reasonable doubt of the identity of the European and American plant.

I feel quite sure that *Hypnum lentum* Mitt. Journ. Linn. Soc. **8**: 36. 1865, is at least nothing more than a variety of *S. caespitosum,* and probably is identical with it. *S. caespitosum* was very little known at the time *Hypnum lentum* was published and a careful reading of the original description will fail to show any distinctions of importance between the two. The matter cannot be definitely settled until Mitten's type is accessible.

SCLEROPODIUM CAESPITOSUM SUBLAEVE R. & C. Bot. Gaz. **15**: 61. 1890

"Pedicel nearly smooth, slightly rough only below the capsule. Oregon, Suavies Island (Th. Howell)." M. Cardot very kindly sent me a portion of this for examination. It agrees with the typical form except as noted above.

Scleropodium colpophyllum (Sulliv.)

Eurhynchium colpophyllum Sulliv. Icon. Musc. Suppl. 95. *pl. 71.* 1874.

Brachythecium colpophyllum Kindb. Can. Rec. Sci. 1894: 73. 1894.

Eurhynchium Macounii Kindb. Rev. Bryol. **22**: 85. 1895.

Gametophyte in wide, soft intricate mats, dirty green: stems creeping radiculose, about 5 cm. long, often stoloniferous, much elongated: branches numerous, erect, about 5 mm. long, terete-foliate, often julaceous: branch leaves closely imbricate when dry, erect-spreading when moist, not decurrent, oblong-lanceolate to broadly-ovate-lanceolate, 1.3–1.5 x 0.45–0.6 mm., acute or broadly acuminate, serrate above, very concave, scarcely plicate; costa extending four fifths length of leaf, ending in a spine on the underside; median leaf-cells long linear, 14–18:1; basal somewhat shorter and broader; a few of the alar cells quadrate: stem leaves triangular-ovate, long and slenderly acuminate, 1.3–1.8 x 0.8 mm. Dioicous, perichaetial leaves with sheathing bases and loosely erect open points, oblong-ovate, slenderly acuminate, costate, nearly entire.

Sporophyte about 15 mm. high: seta light brown, flexuous, twisted to the right, rough with rather distant conical papillae: capsule brown, oblong cylindric, suberect, more or less arcuate, with the operculum about 2 mm. long, 2.5–3:1; slightly constricted under the mouth when dry; operculum conic-rostrate; annulus present, of two rows of cells, easily detachable; segments nearly as long as the teeth, widely split: cilia 2, strongly nodose or subappendiculate; spores minutely roughened, 0.012–0.016 mm., maturing in autumn.

Type locality, California, Bigelow. Type in the Gray Herbarium; examined by the author.

Not rare in California, but frequently confused with *S. caespitosum;* Vancouver Island, Macoun; Alaska, Kellogg.

ILLUSTRATIONS: Sulliv., *l. c.* Evidently Sullivant did not figure any stem leaves as those on the type specimen are quite different from any in the figure in the Icones.

This species is much nearer slender-leaved forms of *S. caespitosum* than is generally recognized. It is distinguished from *S. caespitosum* by its narrower more slenderly acuminate branch leaves, which are more sharply serrate, with median cells longer and narrower, enlarged basal and alar cells much less numerous. In gross appearance the whole plant, and particularly the branches, is much longer. It is undoubtedly a derivative of *S. caespitosum* and intermediate forms are not very rare.

Type specimens of var. *flagelliforme* Barnes have the shorter median cells and the more numerous differentiated basal cells of *S. caespitosum* and seem to me to belong to that species. The slender flagelliform branches are not rare in *S. caespitosum.*

Scleropodium Macounii Kindb. was founded on Macoun's Canadian Musci no. 290. According to the statement of Professor Macoun himself, this number is made up of two collections numbered originally 33 and 212. I find that 33 in his herbarium is *S. colpophyllum* and 212 is *S. caespitosum.* I have examined several of Canadian Musci no. 290 and have found some to be *S. caespitosum* and others to be *S. colpophyllum.* This makes it reasonably sure that *S. Macounii* is a synonym of *S. colpophyllum.* Kindberg states that *S. Macounii* is "monoecious." In this I think he is mistaken, for a careful examination of one of the specimens of 290 which I referred to *S. colpophyllum* showed it to be distinctly dioicous. The male plants were, however, so closely intertwined with the female that at one time I made the same mistake, which was corrected later by a more critical study. Kindberg characterizes the branch leaves as "obtusate." As I am uncertain as to the meaning of the term I do not feel sure whether it tallies with my conclusions or not.

Scleropodium colpophyllum attenuatum var. nov.

Stoloniferous, much more slender with more distant loosely spreading leaves: leaves much narrower with a longer and more slender acumination: branch leaves varying from 1.7 × 0.54 mm. on the longer branches to 1 × 0.2 on the smaller.

Type from perpendicular rocks, Victoria, Vancouver Id., May 2, 1893, Macoun.

Type in the herbarium of the Geological and Natural History Survey of Canada at Ottawa.

DOUBTFUL AND LITTLE KNOWN SPECIES

HYPNUM LENTUM Mitt. Journ. Linn. Soc. **8**: 36. 1865 is undoubtedly a *Scleropodium* and I am confident that it is at most nothing but a variety of *S. caespitosum*. *Vide* notes under that species.

SCLEROPODIUM KRAUSEI (Muell.) R. & C. Rev. Bryol. **20**: 19. 1893.

Hypnum Krausei Muell. Flora **70**: 224. 1887.

M. Jules Cardot very kindly obtained a portion of Müller's type of *Hypnum Krausei* from the Royal Botanical Museum, at Berlin, and sent it to me for examination. In his letter M. Cardot states that it seems to him to belong rather to *Limnobium* than to *Scleropodium*. I entirely agree with this view, for the general habit, the smooth seta, and the costa frequently short and double or forked point very strongly to a close relationship with *Limnobium*.

EXCLUDED SPECIES

SCLEROPODIUM CALIFORNICUM (Lesq.) R. & C. Rev. Bryol. **20**: 20. 1893 is plainly a *Brachythecium* and was so published by Jaeger and Sauerbeck, St. Gall. Nat. Gesell. 1877–78: 326.

EURHYNCHIUM SUBCAESPITOSUM Kindb. Rev. Bryol. **22**: 84. 1895, which he puts in the subgenus *Scleropodium* in the original publication is nothing but a form of *Brachythecium asperrimum* according to specimens kindly communicated by Prof. Macoun.